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ABSTRACT

This pamphlet presents an overview of speech and language disorders including a description of symptoms, possible causes, identification, intervention, and current research. Description of the disorders includes examples of symptoms; the four components and the physical tools of speech; and the role of the brain, including its hemispheres, problems during maturation, and its language centers. Examples are given of speech disorders (phonological impairment, verbal dyspraxia, and dysarthria); language disorders (form errors, content errors, and use errors) and expressive and receptive language disorders. The concept of delay versus disorder is discussed. The process of handicap identification is described, noting conditions which must be ruled out and stressing the importance of early identification and intervention. Current methods of therapy are described, and research is cited indicating that speech disorders may be outgrown by adolescence but that difficulties involving language use may persist into adulthood. Ongoing research involves investigation of differences in brain organization, investigation of the genetic connection, and the use of computers to train children with language impairments to process speech and language more rapidly. Seven organizations are listed to write or call for additional information. A chart of language milestones for ages one through six is also provided. (BRM)

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Developmental Speech and Language Disorders

Hope Through Research

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Cover:
By watching and imitating his speech therapist, this youngster is improving the quality of his speech.

Developmental Speech and Language Disorders—Hope Through Research

Eliza, age 2½, toddles around her nursery school classroom, the straps of her purple overalls slipping off her shoulders. She watches and smiles, and generally she follows directions, but Eliza is silent. The only words she utters are dog to describe a wooden plaything and—when it's time to go home—bus.

Ben is older, nearly 5, and as sweet-faced as little Eliza. But his only "words"—used sparingly in two-word phrases—are all but unintelligible to a stranger. Ben wants to join in the activities of his class, but he cannot understand his teacher's instructions about putting a beanbag on his head, on his shoe, on his shoulder. He simply holds on to the beanbag and smiles, waiting to imitate the other children's responses.

Eliza and Ben are in a special program for preschoolers with speech and language disorders. Eliza is language disordered and has a brain dysfunction: she is delayed primarily in her ability to translate thoughts into language, even though she understands almost everything that a child her age is expected to. Ben is disordered in both speech and language. His problems involve the neurological motor skills that produce speech, as well as the brain function of understanding language. The treatment he requires is more complex. And if Ben has normal intelligence—which can be determined by specialized testing—then this intelligence is masked by his halting, stumbling phrases.

What causes speech and language disorders in children like these? How can the problems be treated? Will children who are slow to speak and understand what is said to them also be slow to read, to write, to think logically? Evidence suggests that the answer to the latter question may be yes for some children, but scientists continue to search for causes and effective treatments that will give parents and professionals a basis for hope. Encouraged by the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS), the primary source of Federal support for research on the brain and disorders of speech

These children may be helped in later years because their speech and language problems were recognized and treated early in life.

and language, investigators around the country are developing new techniques for studying normal and disordered speech and language acquisition as well as treatments for speech and language impairments.

Eliza and Ben have a chance of being helped because their problems have been discovered and are being treated early in life. But many questions will remain unanswered for years. The children will be watched closely when they enter school—Ben probably in a special classroom, Eliza perhaps mainstreamed into a regular school—to see whether their speech and language delays show up later in other guises, particularly as reading disabilities. And as they reach adulthood, another question looms: Will they pass their speech and language difficulties on to their own children?

The scope of the problem

A child with a language disorder has difficulty understanding language or putting words together to make sense, indicating a problem with brain function. A child with a speech disorder has trouble producing the

sounds of language, often resulting from a combination of brain-coordination and neurological motor dysfunction. Either child will lag significantly behind the level of speech and language development expected of a playmate of the same age, environment, and intellectual ability.

Language impairment may show itself in several ways:

- Children may have trouble giving names to objects and using those names to formulate ideas about how the world is organized. For example, they cannot learn that a toy they play with is called car, or that a toy car of another color, or a real car, can also be called car.
- They may have trouble learning the rules of grammar. Such children might not learn, for example, how to use prepositions and other small words like in or the.
- They may not use language appropriately for the context; for example, they might respond to a teacher's question by reciting an irrelevant jingle heard on television.

Speech problems seem to be more prevalent than language problems. Both disorders appear to decline as children get older. Speech disorders affect an estimated 10 to 15 percent of preschoolers, and about 6 percent of children in grades 1 through 12. Language disorders affect about 2 to 3 percent of the preschool population and about 1 percent of the school-age population. In all, nearly 6 million children under the age of 18 are speech or language disordered. Two-thirds of them are boys.

It is difficult to be more precise about just how prevalent the problem is, because the definition itself is so unwieldy. How delayed must a child be to qualify as "disordered"? How does one recognize the delay in the first place?

When is there a problem?

Experts use phrases such as *developmental language disorder, delayed speech, impaired language, motor*

A true delay differs from slow learning.

disorder, and *idiopathic* (no known cause) *speech* and *language disorders* to describe a variety of speech and language difficulties in children. In this pamphlet, delayed speech or delayed language means a problem that appears in the course of the child's development and for which there is no apparent cause. Eliminated from this discussion are speech or language problems that can be traced to deafness, mental retardation, cerebral palsy, or autism.

Speech-language pathologists generally define children as disordered if they lag significantly behind their age peers in reaching certain speech and language milestones. The significance of this lag is determined by a thorough professional examination. British studies show that the range of normal for early language acquisition is enormous. Normal children speak their first word at anywhere from 6 to 18 months, and combine words into phrases for the first time at anywhere from 10 to 24 months. It takes a skilled practitioner to distinguish between a slow child who will eventually catch up and a child with a true delay.

Speech and language professionals have devised a general outline of what speech sounds should have been acquired by a certain age. A child who is not quite on schedule, of course, is not necessarily delayed or disordered; it may just be that the child's individual timetable is different from most children's.

An understanding of what constitutes normal language development is helpful when parents try to evaluate whether their child is abnormally slow. The most widely accepted speech and language milestones for children age 1 to 7 years are outlined in the charts at the end of this pamphlet.

Language problems are most obvious among 2- to 3-year-olds, whose language skills are usually developing very rapidly. Many of these problems subsequently resolve themselves; others require the aid of therapy.

Among older children, speech and language disorders might emerge in a different guise. A 5- or 6-year-old might have caught up in language and social skills

sufficiently to communicate with others, but not sufficiently for good reading or thinking. Such a child could be considered reading- or learning-disabled.

The physical tools of speech

Speech has four components: *articulation, phonation, resonance, and rhythm:*

- *Articulation* is the ability to make specific sounds: the g in gum, the b in bear, the s in snake. Articulation is the component most often affected in children with speech disorders of unknown cause.
- *Phonation* is the utterance of vocal sounds—the voice—produced in the larynx or "voice box."
- *Resonance* is the modification of the voice after it leaves the larynx. The voice is modified by the cavities inside the mouth, nose, and pharynx (the throat).
- *Rhythm*, or what scientists call *prosody*, involves the rate and timing of speech.

For speech to begin, the brain and the vocal and auditory systems must be in good working order. The human vocal system components are perfectly adapted for speech. Our teeth, for example, are usually evenly spaced and equal in size (unless there are dental problems), and our top and bottom teeth can get close enough to pronounce such sounds as s, f, sh, and th. Our lips have more developed muscles than the lips of other primates, and our relatively small mouths can open and shut rapidly to form sounds such as p and b. The size of our mouth opening can be varied to pronounce a range of vowel sounds.

The location of the larynx is perhaps the most important feature of the human vocal system. In the adult human, the larynx, where the vocal cords are located and voice sounds originate, is located further down in the throat than is the larynx of any other primate. This extra room allows humans to modulate speech and to pronounce such sounds as the consonants in gut and cut.

The structures of the vocal system.

Defects in the structure of the lips, palate, or teeth can interfere with a child's ability to make speech sounds correctly. A hole in the palate—the "cleft palate" seen in some newborns—is the most common such problem. A cleft palate can usually be corrected surgically, but even after surgery affected children may have too much nasal resonance and difficulty producing certain speech sounds. Other children with growths in the larynx or vocal cords may have voices with a harsh, husky sound.

The auditory system comprises the three parts of the ear—the outer ear, the middle ear, and the inner ear—and the connections between the inner ear and the auditory center of the brain. The middle ear is prone to infection during childhood because of the angle of the eustachian tube, which connects the middle ear to

the throat. When a child has a cold, the Eustachian tube cannot drain mucus properly, and the fluid that builds up becomes a breeding ground for bacteria. The resulting condition is called otitis media.

If the auditory system is not in good order and a hearing loss exists as a result of continual ear infections and fluid buildup, the child may mishear adult speech and produce it incorrectly. To avoid this problem, an otolaryngologist, a physician who specializes in ear, nose, and throat disorders, should be consulted at the first sign of a hearing loss. The otolaryngologist may refer the child for testing to an audiologist, an expert on the hearing process.

The role of the brain

If scientists were asked to identify the most important feature of the brain that enables humans to speak, they would point to the brain's functional division into left and right hemispheres. This characteristic appears to be related in most people to the brain's asymmetry. Even at birth one can see evidence of this asymmetry. The left hemisphere tends to be larger than the right in most newborns.

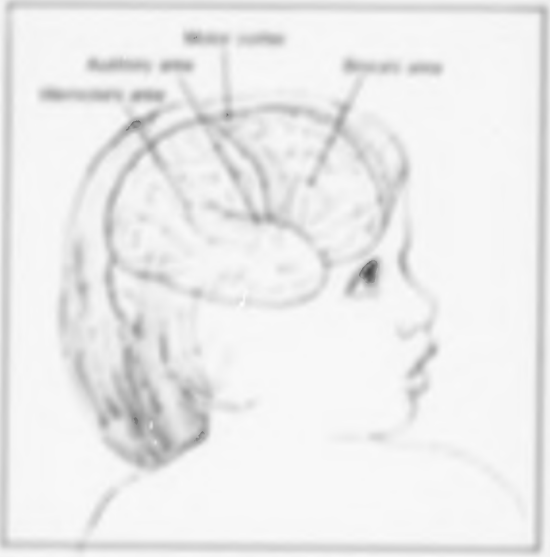
Although most complex functions involve both sides of the brain to some extent, certain functions can be traced to one hemisphere or the other. In approximately 90 percent of us, the right hemisphere controls how we see spatial relationships (such as the recognition of faces) and recognize patterns (such as a musical melody). In that same 90 percent of us, the left hemisphere controls how we process sequences of information involving language.

Neuroscientists once thought that a person's handedness showed which side of the brain was dominant for language: right-handed people were thought to derive language skills from the left hemisphere, left-handed people were thought to draw these skills from the right hemisphere. But we now know that the tendency is for most individuals, no matter which hand they prefer to use, to rely on the left hemisphere for language abilities.

In certain situations, however, the right hemisphere can take over language functions. In young children, for example, the loss of left hemisphere language functions after certain kinds of brain injury can be overcompensated for by the right hemisphere. But in adolescents and young adults the right hemisphere is less able to take over language or speech production.

The nervous system. The development of the brain's asymmetry is part of the overall maturation of the nervous system which occurs before birth. Synaptic pathways that connect to the middle of neurons, nerve cells, or neurons migrate from germinal zones—

The axon of a neuron is covered in a sheath, which also aids the transmission of nerve impulses



The areas of the brain involved in speech and language

loss of language after a brain injury. An adult aphasic with damage to Broca's area has reduced speech that sounds like a message in a telegram: asked about the weather, he might respond "rainy" or, if pressed, "rainy day." An adult with damage to Wernicke's area may articulate well and form grammatically correct sentences, but provides very little coherent information in his speech. Such a patient might answer a question about the weather by saying, "I think it's not good. I don't like it when it's like that." Many aphasic patients may have other language problems as well.

Translating sounds into meaning. Some children may have language difficulty because of a problem with the brain's ability to analyze speech. Research scientists have studied dozens of language-delayed children and found

that they are unable to process rapid speechlike signals produced by a computer. But they can be trained to differentiate among sounds if the time between sounds is prolonged.

Scientists now know that soon after birth, babies are able to detect differences between speech sounds. Investigators have found that infants as young as 1 month can detect the minute differences between closely related speech sounds such as pat and bat.

Most children develop a phonological system, an internal sense of how different categories of speech sounds are used, by about age 3. This system differs according to the child's native language. An English-speaking child, for instance, does not have within his phonological system the same ɣ sound as a Spanish-speaking child, a sound that is somewhere between the English g and th, or the gutteral kh sound of a German-speaking child.

Children must first perceive the unique characteristics of a sound in order to be able to repeat it. But many sounds in the English language differ only minutely—and sometimes the differences are a matter of timing. The difference between the initial sounds for the words bin and pin, for example, is a function of something called voice onset time. To utter the b sound, the vocal cords begin to vibrate almost as soon as the speaker releases air by opening the lips. For the p sound, there is a delay of about 20 extra milliseconds between the time the lips first open and the time the vocal cords start vibrating.

Even though these differences are very small, most persons can discriminate between b and p, or d and t, or g and k—consonants distinguishable by short differences in voice onset time. Speech-language pathologists believe that when children consistently fail to make these distinctions, they may have incorrectly established the sounds in their phonological systems.

Think of what happens to an adult trying to learn a foreign language. The adult can generally imitate the sounds of that language after hearing a word about 50

to 100 times, but still does not know the phonology—the range of possible sounds of the language and the rules for their order. Similarly, a child can imitate the sounds his speech pathologist urges him to make, but to him they're like a foreign tongue. A little boy who speaks like Elmer Fudd, the cartoon character who calls Bugs Bunny a "scwewy wabbit," may be capable of making an r sound the way he's told to, but to him the r sound isn't supposed to sound like an r. He thinks it should sound like a w.

Other influencing factors

The normal development of speech and language depends largely on the health of the brain and the vocal and auditory systems. But children who are abnormally slow in speech or language acquisition may show no signs of physical problems that could explain the delay. In such cases, certain other factors may be slowing things down.

Ear infections. Controversy exists about the relationship between chronic otitis media and the rapidity with which a child learns to speak. Most studies investigating

Early recognition and treatment of ear infections helps avoid the possibility of language-threatening hearing loss.

Environment may also contribute to language-learning problems.

the question have found no clear association between otitis media and language disorder, unless a hearing loss is present. The prudent course is to treat ear infections promptly and to be alert to signs of poor hearing—inattentiveness, failure to respond, requests to have words repeated or to have the television volume raised—in a child with frequent otitis media. Treatment may include antibiotic therapy and the insertion of a tube into the middle ear to drain the fluid. Recent NINCDS-supported studies found that decongestant and antihistamine compounds are ineffective for otitis media but that the antibiotic amoxicillin is effective.

Poor models in the home. The role of the environment in language acquisition has never been fully explained. For example, a normal child whose parent suffers from a language problem may reach full language competence despite an environment in which language models are scant. Psycholinguists, who study the psychological and biological roots of language, believe most children have an innate drive to learn the language of the community no matter what the environment.

But children whose brain structures are abnormal, even in quite subtle ways, may be born with a tendency toward language problems, and if their environments are language-deficient they just don't have the inner resources to compensate. In addition, a vicious cycle of silence is all too easy to establish in the home of a language-impaired child. Parents react to the cues their babies give them. If a baby does not respond with sounds and words, the parent is unlikely to know that the baby is indeed ready for conversation. According to one scientist, the communication difficulties of language-impaired children have a direct impact on the parent's efforts to talk to them.

A collection of disorders

Speech and language disorders wear many faces. Common speech disorders include:

Speech and language disorders take many guises.

- *Phonological impairment,* also called misarticulation. Here the child says the sounds wrong, or omits or duplicates certain sounds within a word. The problem may reflect poor neurological motor skills, a learning error, or difficulty in identifying certain speech sounds. Examples of common errors are wabbit for rabbit, thnake for snake, dood for good, and poo for spoon.

  Another phonological impairment is unstressed syllable deletion, in which a child simply skips over a syllable in a long word, as in nana for banana or te-phone for telephone. Many of these misproductions are a part of normal development and are expected in the speech of very young children, but when they persist past the expected age they are considered abnormal and usually indicate brain dysfunction.

- *Verbal dyspraxia.* This term is used by some scientists and clinicians to describe the inability to produce the sequential, rapid, and precise movements required for speech. Nothing is wrong with the child's vocal apparatus, but the child's brain cannot give correct instructions for the motor movements involved in speech. This disorder is characterized by many sound omissions. Some verbally dyspraxic children, for instance, speak only in vowels, making their speech nearly unintelligible. One little boy trying to say "My name is Billy" can only manage "eye a eh ee-ee." These children also have very slow, halting speech with many false starts before the right sounds are produced. Their speech errors may be similar to those of children with phonological impairment.

- *Dysarthria.* Here muscle control problems affect the speech-making apparatus. Dysarthria most commonly occurs in combination with other nervous system disorders such as cerebral palsy. A dysarthric child cannot control the muscles involved in speaking and eating, so the mouth may be open all the time or the tongue may protrude.

A child with a language problem has difficulty comprehending or using language, and several different types of errors may result. Three of the more common are:

- *Form errors.* These are present when the child cannot understand or use the rules of grammar. A child with this problem might say "We go pool" instead of "We went to the pool."

Language-disordered children seem to have particular difficulty with complex sentence constructions such as questions and negative forms (Table 1).

Table 1. Examples of Form Errors

Correct sentence	Disordered sentence
They won't play with me.	They no play with me.
I can't sing.	I no can sing.
He doesn't have money.	He no have money.
When will he come?	When he will come?
What is that?	What that?

- *Content errors.* This language disorder is involved when the semantics, or what the child understands or talks about, is limited or inaccurate. The child may have a limited vocabulary or may fail to understand that the same word—match, for example—can have multiple meanings.

- *Use errors.* This term concerns what linguists call pragmatics, the ability of the child to follow the rules of communication: when to talk, how to request information, how to take turns. A child with a use error might be unable to ask an adult for help, even though he knows that help is needed and the adult can provide it. Autistic children who have difficulty communicating with people may have use errors.

Categorizing patients

If children with a speech or language problem are to benefit from different treatment approaches now available, they must be accurately subgrouped according to type of impairment. In categorizing speech- and language-impaired children, experts tend to ask two questions. First, is the disorder expressive, receptive, or a mixture of both? Second, is the child simply delayed in speech or language development, or is the child not only delayed but abnormal in speech and language when these skills begin to develop?

Expressive or receptive? Some language-impaired children have primarily expressive (speaking) disorders; others have mainly receptive (understanding) disorders. Most have a combination of both.

Clinicians often encounter children who may be unable to communicate effectively, but nonetheless show signs of understanding others quite well. Consider Becky, a 6-year-old girl seen at a speech clinic. Her conversation with a clinician goes like this:

Clinician: What is your favorite game?
Becky: Doctor.
Clinician: How many can play that game?
Becky: Two four.
Clinician: Two or four?
Becky: Or three.
Clinician: How do you play doctor?
Becky: One has to be doctor.
Clinician: Anything else?
Becky: One operation man.
Clinician: Anything else?
Becky: No.
Clinician: What do you want to be?
Becky: A nurse.
Clinician: Oh, you need a nurse?
Becky: No, you don't.

A child with a receptive language disorder might point to the wagon's bed when asked to point to the wagon's wheels.

Becky has an expressive language disorder. Her responses are limited to incomplete sentences that may be inappropriate to the question, and they reveal Becky's inability to use verbs, conjunctions, or any of the subtleties of language. Like some children with expressive language problems, Becky has a good vocabulary, but she has difficulty connecting words. Even though she is 6, she talks like a 2-year-old.

Children with expressive language problems may or may not have articulation problems. But even if their speech is perfectly articulated, communication is impaired because language remains ungrammatical, reduced, babyish.

Paul, who is 7 years old, is Becky's opposite, a child with a receptive language disorder who has difficulty understanding language. Receptive language problems rarely occur alone; usually they are accompanied by at least some degree of expressive language disorder. The

Diagnosis often begins with the pediatrician.

condition often is misdiagnosed as attention problems, behavioral problems, or hearing problems. Standardized language tests may reveal, though, that a child with a receptive language disorder is trying to cooperate but simply cannot understand the instructions.

Paul, for instance, cannot point to a picture that best reveals his understanding of single vocabulary words or of grammatical associations between words. When asked to point to a picture of "the ball under the table," Paul might just as readily point to a picture of a ball on the table. When asked to point to the picture of "the boy running after the girl," he might instead choose the one of a girl running after a boy.

Delay or disorder? Scientists have not agreed on whether language-impaired children acquire language normally—but more slowly—than other children or whether they develop language in an abnormal way when they begin to talk and understand. If any consensus has been reached in the past decade, it is that both sides may be right. There may be two quite separate conditions, one in which speech or language is delayed, and another in which speech or language is not only delayed but also incorrect.

In the 1970's, several groups of scientists tackled the problem. Generally, children had been categorized according to certain measures of language development such as the average length of spontaneous sentences. One study found that language-impaired children used simpler grammatical sentences and fewer questions than other children. Another study found that language-impaired children understood the meanings and relationships of words in much the same way that other children did. Language-impaired children seemed to develop their ability to express themselves in the same progression as normal children, but only after they had reached a higher-than-normal level of language comprehension.

The general consensus from research of recent years is: many language-impaired children seem to be merely

delayed, but a sizable number also develop language in an abnormal way. The distinction is important, because it can help clinicians recognize that some children should be treated aggressively and others left alone.

A visit to the doctor

A child whose parents suspect a speech or language disorder will probably enter the health care system through the pediatrician's office. Before referral to a speech-language pathologist for assessment, the physician will try to determine if there are underlying conditions that might be the indirect cause of the speech or language delay.

This mother and her child's physician discuss test results to determine if the boy has a speech or language disorder.

A child is likely to be tested to rule out the following conditions:

- *Hearing problems.* Language acquisition is a continual process of hearing, imitating or spontaneously trying a word or phrase, hearing one's own productions, and refining them. Scientists have observed that infants who have impaired hearing from birth tend to be delayed in their instinctive babbling and produce fewer different sounds.

A physician faced with a child over 2 years old who [illegible] audiological testing. Such tests involve the use of tones delivered through headphones: as soon as the tone is heard, the child responds by raising a finger or performing some other behavior or gesture. Occasionally, children with hearing problems may unintentionally hide their conditions from their parents because they become so adept at using environmental cues—facial expressions, vibrations, and what little hearing they have—to get by. These cues fall short of helping the children learn the complex sounds of language.

This child is undergoing audiological testing to diagnose her speech and language problems. When she hears a tone in one ear, she got signals the technician by holding a wood block up to that ear.

• *Mental retardation.* The developmental language disorders described in this pamphlet occur in children of normal or above-normal intelligence. However, language problems are also common among the mentally retarded. Experts estimate that nearly half of all mildly retarded children, 90 percent of severely retarded children, and 100 percent of profoundly retarded children have language disorders of some sort.

Children may mask poor hearing by responding to facial and other cues

A pediatrician may suspect mental retardation if the delay in achieving speech and language milestones is similar to delays in achieving other developmental milestones. Gross neurological motor development—sitting, standing, crawling, and walking—and fine motor development—reaching, grasping, building towers of blocks—are often interpreted as clues to whether a child's mental capacities are normal. If mental retardation is a source of concern, tests are available to see just where a child ranks with his or her age peers in mental and physical areas of development. These tests involve such tasks as having the child imitate an examiner's arrangement of blocks or copy geometric shapes.

- *Autism.* One of the hallmarks of the disorder called autism is the inability of the child to communicate. Autism begins before age 2½ years; it includes particular speech and language problems, total lack of language, a pervasive lack of responsiveness to people, and peculiar speech patterns. The latter include immediate or delayed echoing of another's comments, speaking in metaphors, or reversing pronouns. In addition to having communication problems, autistic children may be resistant to change, may be overly attached to objects, and may have bizarre and unexpected responses to their environments. A child neurologist will ask about the child's behavior to rule out autism.

- *Cerebral palsy.* The muscle control problems characteristic of cerebral palsy can sometimes interfere with speaking. When this happens, children may understand language better than they can speak. They may have trouble expressing themselves because of difficulty moving their lips or tongue.

- *Acquired aphasia.* Children are considered aphasic when the brain injury that causes loss of language occurs after speech and language have begun to develop. Aphasia can occur after severe head trauma or a brain infection. Some acquired aphasia is an unfortunate consequence of surgery, as is those rare cases when children

on grasping the content of language. Children play with toys and are taught to translate their activities into words—a mode of learning that is more meaningful for them and that gives them the tools to construct their own sentences.

For the child whose speech is impaired or delayed, treatment may focus on one sound group at a time, starting with the sounds that babies naturally learn first. Young clients are encouraged to say the sounds in a variety of contexts, to watch the clinician make the sound—even putting their hands on the clinician's throat or mouth while the sound is spoken—and to watch themselves make the sound, putting their hands on their own mouths and watching themselves in a mirror.

The most important and continuous help comes from parents. Guided by speech and language pathologists, parents can do a great deal to improve the language environment in their home.

Reading to a child and expanding on the child's comments can help in language development.

Parents' verbal responses can help expand language skills.

Parents can learn better ways to respond to their children's utterances so that language skills improve. When a child says, "more milk," a parent may respond several ways. The least helpful are silently to refill the milk glass, or to say, "here milky in cuppy," or some other form of nongrammatical babytalk. But adults are tempted to give such answers with youngsters who never seem to benefit from more sophisticated replies such as, "Do you want more milk?" A better response would be the simple statement, "More milk for Sam."

If the parent peppers responses with what linguists call *expansions*—new words, new sentence constructions, new rules of grammar—the child can eventually learn new bits of language (Table 2). Expansions introduce new information or help the parent develop the child's words into a grammatically correct sentence.

Table 2.
Ways Adults Can Help a Child Learn Language

1. Expand the statement, preserving the child's intent.
   a. Expand the statement using the same noun.
      Child: kitty jump
      Adult: The kitty is on the chair.
   b. Replace the noun with a pronoun.
      Child: kitty jump
      Adult: She is jumping.
   c. Expand the statement adding new information.
      Child: kitty jump
      Adult: The dog is jumping, too.
2. Respond by indicating the truth value of the child's utterance, rather than its linguistic accuracy (or inaccuracy).
   Child: kitty jump
   Adult: Yes, the kitty is jumping.

The long-term outlook

How do speech- and language-impaired children fare in adolescence and adulthood? Most followup studies indicate that speech disorders tend to be outgrown by adolescence, but that difficulties involving language use, production, or understanding can persist into adulthood.

One study from the University of Iowa examined 36 adults, 18 of whom had been diagnosed as speech-disordered and 18 as language-disordered when they were children. Nine of the language-disordered children still had communication and learning difficulties in adulthood, compared to only one in the speech-disordered group.

A Cleveland-based study of 63 preschoolers with speech and language disorders found that 5 years after initial diagnosis, 40 percent of the children still had speech and language problems, and 40 percent had other learning problems such as below-normal achievement in reading and in math. NINCDS-supported scientists at the University of California at San Diego are now conducting a study of 100 language-impaired 4-year-olds to see how they fare up to 5 years after identification of their language problems. Preliminary results suggest that children with only expressive language losses have a lower risk of long-term problems than do children with both expressive and receptive impairments.

The promise of research

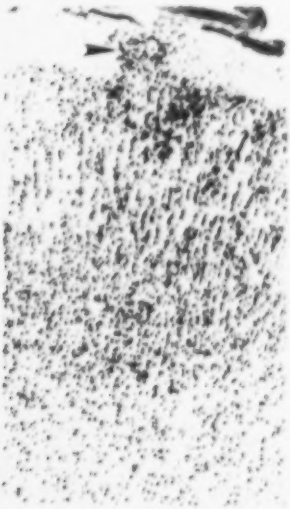
Scientists are pursuing research leads that promise improved therapy for children with speech and language disorders. Studies of these disorders are supported by NINCDS, other Federal agencies including the National Institute of Mental Health and the National Institute of Child Health and Human Development, and private and medical institutions.

The brain's organization. Studies of cell structure in the brains of dyslexic individuals—otherwise normal people who have extraordinary difficulty learning to

read—show that speech and language disorders may be caused by abnormal development of the brain's language centers sometime before or soon after birth.

"From the middle of gestation until about the first or second year, the actual floor plan of the brain is being laid down," says one of the NINCDS grantees who conducted these studies at Boston's Beth Israel Hospital.

Using a technique called cytoarchitectonics, in which the actual structure and arrangement of cells is revealed, the investigators examined the brains of seven adults who had been diagnosed as dyslexic. They found a series of abnormalities in the cerebral cortex. These included *ectopias,* neurons found in the language centers of the brain that seem to have arisen elsewhere and migrated to the wrong area; *dysplasias,* or misshapen neurons; and so-called *brain warts,* neurons that are nodular in appearance. The brains also failed to show the normal degree of asymmetry.



A cluster of nerve cells (see arrow) is found in the outer cortex of a dyslexic patient's brain. Normally, there are no nerve cells in the outer cortex.

Brain imaging techniques may reveal the site of sound processing.

Other methods are being used to study how the brain may be abnormal in children with speech or language disorders. Some scientists are using brain imaging techniques to try to locate the site of auditory processing in the brains of children with expressive and receptive language impairments. These investigators hope to pinpoint regions where speech sounds are processed and to see how those regions differ between language-impaired and normal children.

The genetic connection. Speech and language problems seem to run in families. This could be accounted for by environmental influences: a home in which language is misused is a home where children develop poor language skills. But most scientists think there may be a large genetic component. Investigators are now studying families with speech and language problems to find out how these disorders are inherited.

Scientists studying speech and language problems have developed a computer program that translates speech into a visual pattern so a child can see the difference between certain sounds.

This child is being asked to remember and repeat the hard-to-pronounce, nonsense name of the stuffed monkey. Her responses will help scientists characterize different patterns of word avoidance in language-delayed and normal children.

Speeding things up. Some language disorders may originate in the abnormally slow rate at which the child's brain is able to process information. To test this theory, scientists are experimenting with ways to train language-impaired children to process speech and language more rapidly. NINCDS grantees at the University of California at San Diego are using computers to teach children to hear the most subtle sound shifts—such as those that differentiate ba from da—by exaggerating those differences. The computer produces and gradually speeds up speech sounds until the children can hear the ba/da distinction at the rate at which it occurs in ordinary conversation.

Some language-delayed children avoid words that are hard to pronounce. In an NINCDS-supported study of word avoidance, scientists at Purdue University are asking both normal and language-delayed children to say the hard-to-pronounce nonsense names assigned to unusual objects and toys. By characterizing the patterns of word avoidance in the two groups, the scientists hope to devise improved treatment methods for the language-delayed children.

As scientists learn more about how the normal brain controls language and initiates speech, they will also discover just what goes wrong in brains when problems arise. After the underlying mechanisms are detected, investigators hope to develop new treatment techniques to help the millions of children whose thoughts and feelings are poorly expressed.

Where to get help

A number of private organizations have been set up to help people with speech and language disorders. These organizations distribute educational materials and, in some cases, provide lists of treatment experts. For more information, call or write to the following organizations:

American Speech-Language-Hearing Association
10801 Rockville Pike
Rockville, MD 20852
(301) 897-5700

The Council for Exceptional Children
Division of Children with Communication Disorders
1920 Association Drive
Reston, VA 22091
(703) 620-3660

National Association for Hearing and Speech Action
Suite 1000
6110 Executive Boulevard
Rockville, MD 20852
(301) 897-8682

National Easter Seal Society, Inc.
2023 West Ogden Avenue
Chicago, IL 60612
(312) 243-8400

The Orton Dyslexia Society, Inc.
724 York Road
Towson, MD 21204
(301) 296-0232

Tourette Syndrome Association
42-40 Bell Boulevard
Bayside, NY 11361
(718) 224-2999
(800) 237-0717 (toll free)

NINCDS information

For more information about the research programs of the NINCDS, contact:

Office of Scientific and Health Reports
National Institute of Neurological and
Communicative Disorders and Stroke
Building 31, Room 8A-16
National Institutes of Health
Bethesda, MD 20892
(301) 496-5751

Language Milestones*

Child's age	Speech behavior the child should have mastered
1 year	Says 2 to 3 words (may not be clearly pronounced)
	Repeats same syllable 2 to 3 times ("ma, ma, ma")
	Carries out simple direction when accompanied by gestures
	Answers simple questions with nonverbal response
	Imitates voice patterns of others
	Uses single word meaningfully to label object or person
2 years	Says 8 to 10 words by age 1½, 10 to 15 words by age 2
	Puts two words together ("more cookie," "where kitty?")
	Points to 12 familiar objects when named
	Names 3 body parts on a doll, self, or another person
	Names 5 family members including pets and self
	Produces animal sound or uses sound for animal's name (cow is "moo-moo")
	Asks for some common food items by name when shown ("milk," "cookie," "cracker")

*(Adapted from the Portage Guide to Early Education, ©1976, Cooperative Educational Service Agency.)

3 years	Produces two-word phrases combining two nouns (“ball chair”), noun and adjective (“my ball”), or noun and verb (“daddy go”)
	Uses no or not in speech
	Answers where, who, and what questions
	Carries out a series of two related commands
	Consistently uses ing verb form (“running”), regular plural form (“book/books”), and some irregular past tense forms (“went,” “did,” “was”)
	Uses is and a in statements (“This is a ball.”)
	Uses possessive form of nouns (“daddy’s”)
	Uses some class names (“toy,” “animals,” “food”)
4 years	Uses a vocabulary of 200 to 300 words
	Uses is at beginning of questions when appropriate
	Carries out series of two unrelated commands
	Expresses future occurrences with going to, have to, want to
	Changes word order appropriately to ask questions (“Can I?” “Does he?”)
	Uses some common irregular plurals (“men,” “feet”)
	Tells two events in order of occurrence

5 years	Carries out series of three directions
	Demonstrates understanding of passive sentences ("Girl was hit by boy.")
	Uses compound and complex sentences
	Uses contractions (can't, don't, won't)
	Points out absurdities in picture
	Tells final word in opposite analogies
	Names picture that does not belong in particular class ("one that's not an animal")
	Tells whether two words rhyme
6 years	Points to some, many, several
	Tells address and telephone number
	Tells simple jokes
	Tells daily experiences
	Answers why question with an explanation
	Defines words

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